DO TORTOISE BEETLE PUPAE MIMIC LACEWINGS?

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At first, this question may seem rather strange; how could the stout, wingless, wholly functional carapace of any coleopterous pupa resemble, in the slightest, the delicate winged and lithe form of the Neuroptera? The answer, as I hope the accompanying photographs show, is 'yes, when seen in profile'. I would argue that this is not just coincidental, not an accident of light, and not a trick played by a notorious trickster—the camera. However, it was the sight through the camera viewfinder that revealed this resemblance, a sight not usually seen by the field entomologist because the combination of focal length of the macro-lens and extension tubes produces an image on an insect-to-insect scale. Even armed with a hand lens, the perspective and depth of field of this image is not usually available to the human eye.

During its five larval instars, the tortoise beetle larva, in this case *Cassida viridis* L., carries about its previous larval skins, ornamented with its own droppings, in the form of a 'parasol' which it waves over its back to deter any would-be predator, or which camouflages the larva by resembling a bird dropping or other rubbish. The particular structure which allows the larva to do this is a long bifurcate prong called the caudal furca, caudal process, anal fork, or even 'feces fork' (Gressitt, 1952). By the time it pupates, the accumulated exuviae and frass may

Fig. 1. The fifth instar larva of *Cassida viridis* waves its 'parasol' of accumulated shed skins and frass over its back while continuing to eat the mint leaf. Photo: R. A. Jones.

be almost as large as the larva itself (Fig. 1) and remains a deterrent and camouflage throughout the pupal stage.

The 'merdigerous' behaviour of tortoise beetle larvae is well known and well documented (Westwood, 1839; Sharp, 1909; Van Emden, 1962). But should the loose bundle of dried exuviae be disturbed from the pupa, only the first four instar skins become dislodged, leaving the fifth and final instar skin still firmly attached (Fig. 2). It is now that the profile of the pupa comes to resemble a lacewing (Figs 3 and 4).

This resemblance is not fanciful, although it may be coincidental in that the pupa resembles a generalized insect form, with porrect 'head and thorax'. The caudal process comes to resemble two prominent antennae, the hind two lateral processes come to resemble large prognathous jaws while other lateral processes come to resemble legs.

This type of mimicry, where the relatively expendable tail-end of a creature distracts attack from the vulnerable head-end is common throughout the insect kingdom. The tails of 'tailed' butterflies, be they swallowtails, blues, skippers or hairstreaks, are supposed to resemble antennae and lure the attacks of birds away from the real antennae. Likewise, the eye spots of many butterflies resemble eyes, confounding a predator. The streaked markings at the wingtips of various microlepidoptera resemble eyes, legs and antennae when the moths are at rest, giving the impression of a reversed head/tail axis, e.g. *Ancylis badiana* (D. & S.), some *Glyphipteryx* species, and in particular many *Leucoptera* species. Some small leafhoppers (Hemiptera: Cicadellidae) have similar markings.

Thus, the resemblance of the *Cassida* pupa to a lacewing is not as comical as it might seem. It could be that an attacking predator is fooled into pecking or biting at the erect 'head', but instead of snatching up a tasty morsel, comes away with

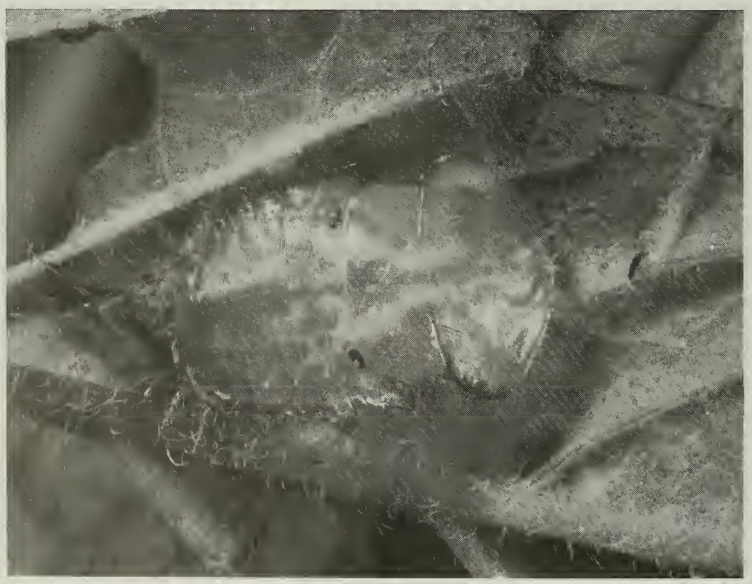

Fig. 2. Dorsal view of the *Cassida* pupa, the caudal process and other remains of the fifth larval skin are clearly visible, although in this aspect not strikingly so. Photo: R. A. Jones.

Figs 3 and 4. Pupa of *Cassida viridis*, in side view. The resemblance to a lacewing now becomes apparent. The 'antennae' are the remnants of the caudal process, the 'jaws' the hind-most lateral processes and the 'legs' other lateral processes of the shrivelled larval skin. Photos: R. A. Jones.

a dry husk of dead skin. Should its first line of defence, subterfuge under what looks like bird manure, fail it, the pupa can hope for a second chance by offering its fifth cast skin as a decoy head and shoulders, and if this disguise is removed it must hope that its final flattened form, held tight onto the leaf, will conceal it until the adult beetle emerges, a few days later.

References

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BOOK REVIEW

Australian weevils, by E. C. Zimmerman. Melbourne, CSIRO, Volume 5, colour plates 1–304, 1991 and Volume 6, colour plates 305–632, 1992.—This ambitious series is envisaged to comprise 8 volumes, the remaining six (text) volumes to be published by 1996. Although perhaps only of peripheral interest to British entomologists, or to weevil specialists, the books are remarkable for their colour plate presentation of the insects themselves.

Each of the 632 colour plates is made up of 8 photographs arranged two by four down the page. Each pair of photographs shows dorsal and side view of a single specimen. A uniform blue background and careful lighting show the delicate colouring, sculpturing and scaling of each beetle to full advantage. Each specimen is mounted on a card point (occasionally one is pinned), allowing many underside characters to be seen in side view. The odd head or tail is shown in particular close-up and there are a few general shots of habits, but most of the plates are given over to this novel presentation. Books such as these represent landmark achievements; debate on whether photographs or paintings are superior hinge about them.

The various editions of South's *The moths of the British Isles* are accorded greater or lesser status depending on their colour plate style. With the appearance of Skinner's *Moths of the British Isles* photography looked set to take over from paintings, at least for the Lepidoptera. On the other hand set specimens of beetles are not so photogenic; the carabid volumes of the *Fauna Entomologica Scandinavica* series (Lindroth, C. H., 1985 and 1986) contained 8 colour plates from photographs and worked well enough for some of the prettily marked species.

At the BENHS's own annual exhibitions, highly interesting specimens are selected for photographic reproduction in the journal. Where butterflies and moths are regularly chosen, the occasional fly or bee makes an appearance, but beetles are seldom done justice, though not for want of interest on the part of the exhibit or technological expertise on the part of the photographer. At life size reproduction, beetles just do not photograph well. Here then is an example of how beetle photography can work—at between two and twenty times life size.

The lavish production of these two volumes could not have been possible without what must be some considerable financial input from the author and friends to subsidize the publishing costs. The author's faith in financing such a venture must surely be rewarded by the knowledge that the books are a remarkable achievement. The text volumes are awaited with interest.

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